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**DESCRIPTIONS ON THE AGGREGATED FORM OF
BROOKSIA ROSTRATA (TRAUSTEDT),
AN INSUFFICIENTLY KNOWN SALPA¹⁾**

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With Plates IX-X and 4 Text-figures

- Salpa rostrata* APSTEIN, C. (1894): Die Thaliacea der Plankton-Expedition. B. Verteilung der Salpen. Ergebn. Plankton-Exped., Bd. 2, E a, pp. 16-19, Pl. II figs. 17-22, Text-fig. IX.
- Brooksia rostrata* METCALF, M. M. (1918): The Salpidae: a taxonomic study. U. S. Nat. Mus. Bull. 100, Vol. 2, Part 2, p. 52, Fig. 24.
- IHLE, J. E. W. (1935): Desmomyaria in KÜKENTHAL & KRUMBACH Handb. d. Zool., Bd. 5, Hälft. 2, Lief. 5, p. 476.
- IHLE, J. E. W. (1939): Salpidae in BRONNS Kl. u. Ord. Tierreichs, Bd. 3, Suppl. Tunikaten, Abt. II 2, Lief. 3, pp. 188 & 222, Fig. 167.
- THOMPSON, H. (1948): Pelagic tunicates of Australia. Melbourne, pp. 121-123, Pl. 43 figs. 2 & 3, Text-fig. 13.
- YOUNT, J. L. (1954): The taxonomy of the Salpidae (Tunicata) of the central Pacific Ocean. Pacific Science, Voll. VIII, No. 3, pp. 293-295, Fig. 9a.

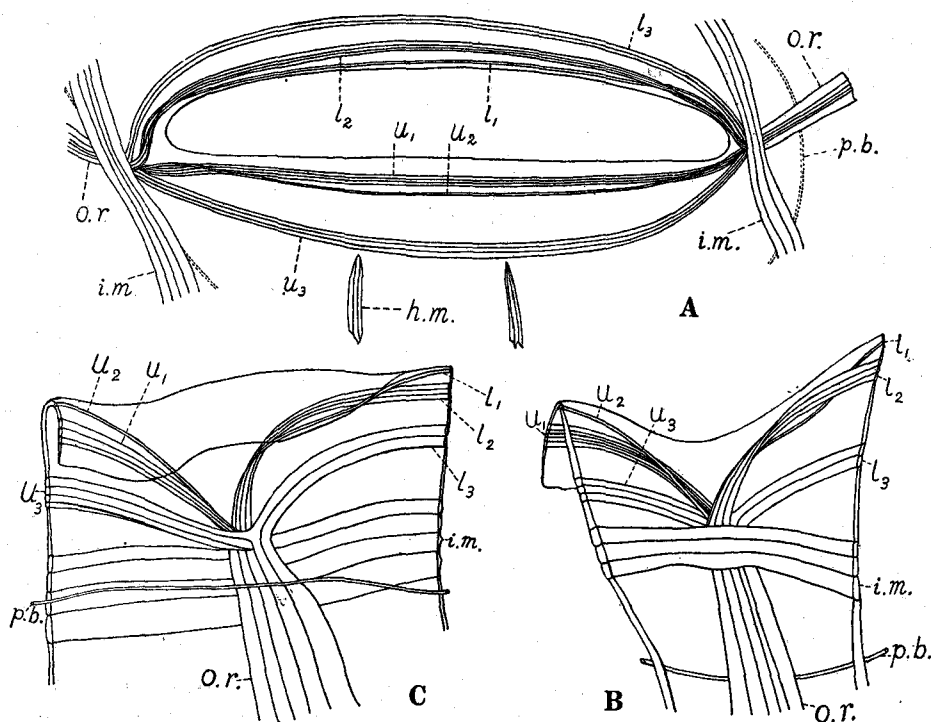
Eleven individuals were found in plankton samples collected by members of the former Fisheries Experimental Station of the South Sea Islands in the neighbouring waters of the Palao Islands in 1940. They were 0.8 mm—2 mm in body length and more or less mutilated excepting a few individuals nearly in a perfect condition. Test is so delicate that it is almost lost in these preserved specimens. Body roughly oval in outline (Pl. IX) and has a stout anterior attachment process (at. pr.₁) of a considerable length on the left side in the sinistral individual and on the right in the dextral one, and two processes on the right side in the sinistral individual and on the left in the dextral one. Of the two processes, the middle attachment process (at. pr.₂) is small and situated at the side of the oral aperture, while the posterior process (at. pr.₃) is larger than the middle one and situated slightly posterior to the middle of the body. Oral aperture dorsal; atrial aperture dorsal in the sinistral individual, but terminal or subterminal in the dextral individual. Nucleus compact and situated at the posterior end in the sinistral individual, while slightly in front of the rear end of the body in the dextral individual. A long protuberance is protruded posteriorly

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from the rear end of the nucleus and contains the testis in its distal swelling. This protuberance, the testicular process, may be slightly longer than a half of the body length when it is long.

Musculature

Oral muscles (Text-fig. 1): Both upper and lower lips are provided each with three sphincters, all complete and gathered to a short but stout retractor at each side of the mouth. u_2 and l_1 are very thin. Muscle fibres of l_3 and l_2 and one of u_3 are continuous to fibres of retractors, while others join to the retractor at the angle. Intermediate muscles (i. m.) of both sides touch each other at the anterior attachment process; dorsally the left intermediate muscle fuses with the first body muscle (I) and the right one joins to I in the sinistral individual, while the left muscle joins to I and the right one fuses with I in the dextral individual. Horizontal muscles are short and do not reach to u_3 . Numbers of fibres of these oral muscles are as follows:



Text-fig. 1. *Brooksia rostrata* (TRAUSTEDT), aggregated form.
 Oral musculature, enlarged. A—Entire musculature, B—Right angle, from outside;
 C—Left angle, from inside.

h. m. ... Horizontal muscle, i. m. ... Intermediate muscle, o. r. ... Oral retractor, p. b. ...
 Peripharyngeal band, l_1-l_3 ... First to third sphincters of lower lip, u_1-u_3 ... First
 to third sphincters of upper lip.

u_1 3-5	l_3 2
u_2 1	retractors 5
u_3 3-4	intermediate muscles 3-4 (dorsal)
l_1 1 4-5 (ventral)
l_2 3	horizontal muscles 3

Body muscles (Plate IX): APSTEIN (1894) gave, in the dextral zooid, 4 muscles on the right and 3 ones on the left side. This statement differs from the actual feature observed in fully grown individuals. THOMPSON (1948) does not describe clearly about the number of body muscles, although his figure (Pl. 43, fig. 2) shows strictly the outline of these muscles. YOUNT (1954) correctly gives 4 muscles on one side and 5 ones on the other side. The arrangement of body muscles is, however, not yet described fully, so I wish to give below some details of the arrangement taking up the sinistral individual (Pl. IX, figs. A & B) as an example. The arrangement in the dextral individual (Pl. IX, figs. C & D) may be easily understood as a mirror image of that in the sinistral individual.

On the dorsal side: i.m., I and II on the left side are united into a broad muscle band running obliquely towards the right posterior where it is divided into III, IV and another muscle which is then divided into V and first atrial sphincter (X). I and II on the right side are also united into a band running obliquely beneath the band, compound of i.m., I and II, towards the left posterior where it is divided into III, IV and X. Numbers of fibres of body muscles and X are as follows:

I 3	i.m. + I (left) ... 6-7
II 3	i.m. + I + II (left) → III + IV + V + X (right) ... 10
III 3	III + IV (right) ... 6-7
IV 3 (left), 4 (right)	V + X (right) ... 6
V 3	I + II (right) → III + IV + X (left) ... 6-10
X 3	IV + X (right) ... 6

IV on the right side ends in the posterior attachment process, while it goes on ventrally on the other side. The right X proceeds far into the posterior protuberance to the testis, while the left one goes round the corner of the atrial aperture and reaches near the anus.

On the ventral side: There is a strong muscle band (ob.m.) running obliquely from the anterior attachment process to the posterior one. I-IV on the left side are all continued to that oblique muscle, II and III are fused with each other before they reach ob.m. I on the right side appears on the ventral side round the posterior side of the middle attachment process and joins to ob.m. at the point just opposite the place where II+III on the left side reaches ob.m. III on the right side also joins to ob.m. at the point opposite the place where IV on the left side reaches ob.m.; from this joining point another short oblique muscle, demi-oblique muscle (d.ob.m.), starts for the middle attachment process and runs across I along the outer side. Right II ends freely near d.ob.m., V enters the space between ob.m. and IV at the posterior attachment

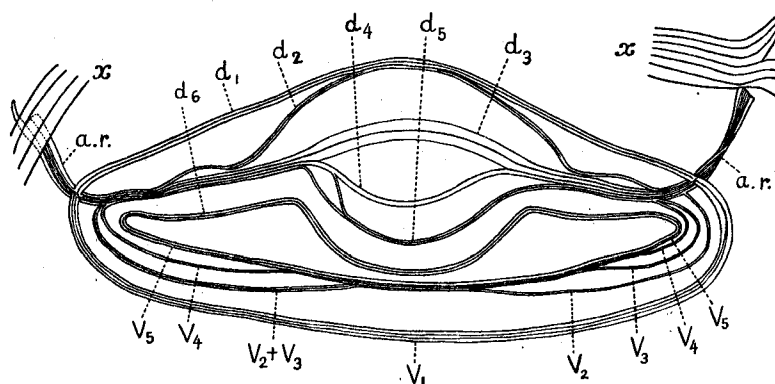
process and touches both muscles. Numbers of muscle fibres are :

ob. m. 4 (anterior) → 9-10 (middle) → 3 (posterior)

d. ob. m. 3

It is a noticeable phenomenon that IV on the left side increases in number of fibres, up to 6, before the muscle reaches ob. m. (Pl. IX, fig. E).

Atrial muscles (Text-fig. 2): Besides the thick first atrial sphincter (X), there are many thinner sphincters on atrial lips, six on the dorsal and five on the ventral lip. d_6 continues to v_5 on the ventral lip and independent of the atrial retractor. d_1 and d_2 are touching medially each other, d_3 , d_4 and d_5 are united at each side into a thick band in a considerable length and only d_6 is quite free. Of these sphincters d_3 is very remarkable in its broadness. v_2-v_5 are united medially into a band, the free parts of these muscles being diminished distally; v_1 is free. Fibres



Text-fig. 2. *Brooksia rostrata* (TRAUSTEDT), aggregated form.

Atrial musculature, enlarged. a. r. ... Atrial retractor, d_1-d_6 ... Second to seventh sphincters of dorsal lip, v_1-v_5 ... First to fifth sphincters of ventral lip, x ... First atrial sphincter.

of d_2-d_5 and v_2-v_4 are continued to those of the atrial retractor; d_1 and v_1 join to the retractor, but are not fused with it. The left retractor reaches beneath X, while the right one attains near X. Numbers of fibres of atrial sphincters are as follows:

d_1 2	} d_1+d_2 3	v_1 3	} v_2-v_5 3
d_2 1-2		v_2 1	
d_3 2	} d_3-d_5 5	v_3 1	
d_4 1		v_4 1	
d_5 2		v_5 1	
d_6 1		retractors 7	

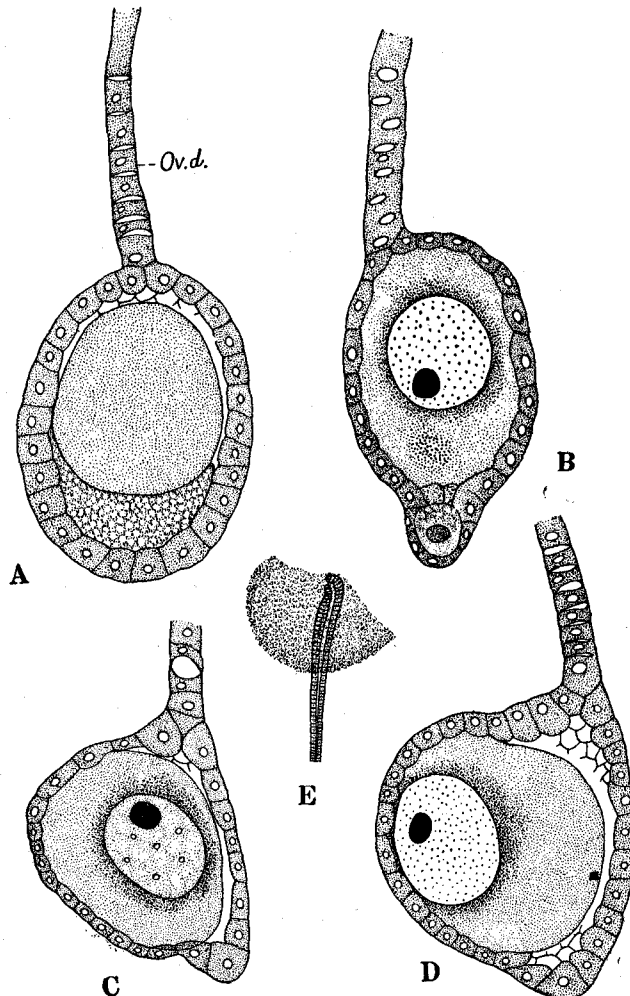
Alimentary Organs

The endostyle is short, the anterior end is strongly curved dorsads and the posterior end is situated near the joining point of I to ob. m. The nucleus seems

to be in "der Zustand E". The right blind sac is roundish in outline, while the left one is elongate in shape and larger than the right sac. Generally some remains of the eleoblast are found at the rear side of the nucleus (Pl. X, figs. A-E).

Reproductive Organs

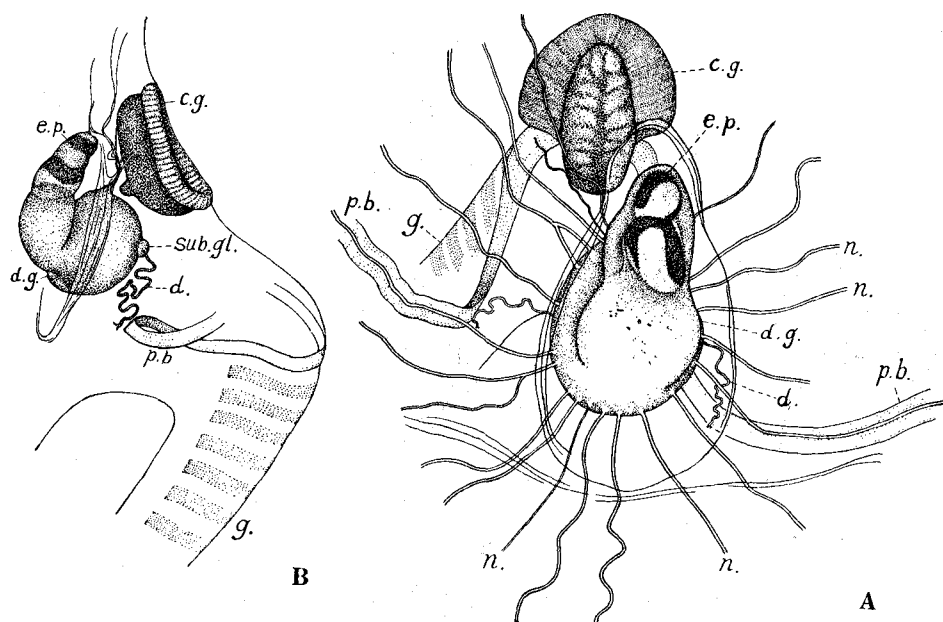
Testis (Pl. X, figs. F-I): Fully matured testis consists of 5 lobules, each slender and simple cylindrical in outline. In younger individuals, the testicular process is



Text-fig. 3. *Brooksia rostrata* (TRAUSTEDT), aggregated form.
 A—Ovary containing a fertilized egg, B—Ovary containing a small excess ovum, C & D—Ovary containing an unfertilized egg, E—Opening of oviduct, all $\times 630$.
 ov. d. ... Oviduct.

very short and the testis consists of merely a single mass; the process and the testicular lobules seem to grow or increase in number with age. Vas deferens opens near the anus.

Ovary (Text-fig. 3): At first the ovary is situated between the atrial aperture and the nucleus (\times in Pl. X, fig. A), but carried forwards in the development near III in the dextral individual and V+X in the sinistral one. Usually an egg is found in the ovary, although another small excess ovum may be observed in rare cases (Fig. B). Embryo always single.



Text-fig. 4. *Brooksia rostrata* (TRAUSTEDT), aggregated form.

A—Ciliated groove and dorsal ganglion, dorsal; $\times 200$. B—The same portions from the right side, $\times 110$.

c. g. ... Ciliated groove, d. ... Duct of subneural gland, d. g. ... Dorsal ganglion, e. p. ... Eye-pigment, g. ... Gill, n. ... Nerve, p. b. ...Peripharyngeal band, sub. gl. ... Subneural gland.

Sensory Organs

The proper part of the ciliated groove is elongate in shape and fringed with rather wide border. It is situated obliquely at the antero-ventral side of the dorsal ganglion and issues a minute prominence towards the ganglion. The eye-pigment consists of two \cap -shaped parts. The subneural gland small, a pair of ducts from the gland meandering in their ways and open each to the pharynx near the peripharyngeal band (Text-fig. 4).

EXPLANATION OF PLATES IX-X

PLATE IX

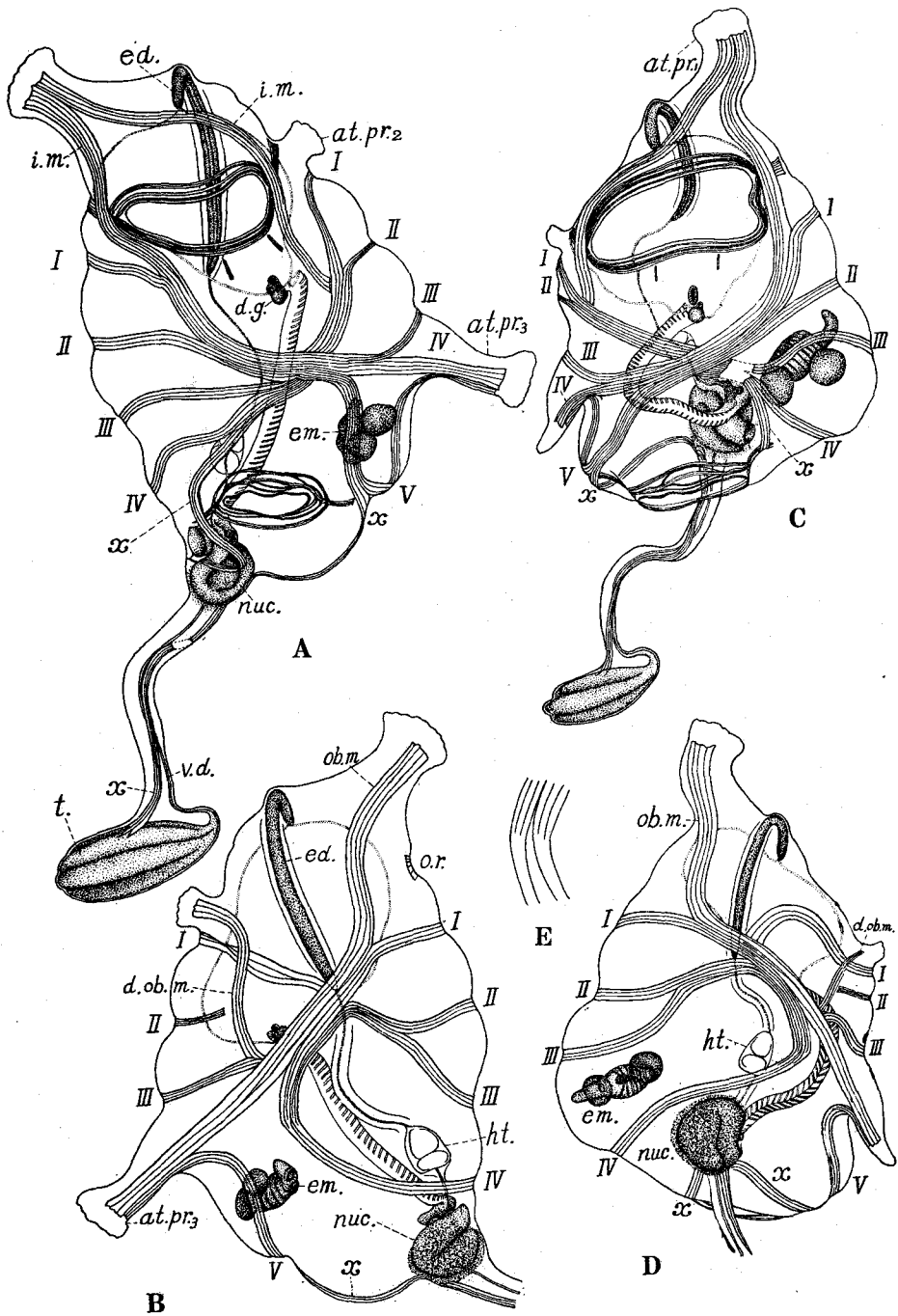
Brooksia rostrata (TRAUSTEDT), aggregated form; test removed.

- A...Dorsal side of a 2 mm long sinistral individual.
 B...Ventral side of the same individual.
 C...Dorsal side of a 1.8 mm long dextral individual.
 D...Ventral side of the same individual.
 E...Increasing point of muscle fibres in IV, enlarged.
- | | |
|--------------------------------------------------------|--------------------------------------|
| at. pr. ₁Anterior attachment process | i. m.Intermediate muscle |
| at. pr. ₂Middle attachment process | nuc.Nucleus |
| at. pr. ₃Posterior attachment process | ob. m. ...Oblique muscle |
| d. g.Dorsal ganglion | o. r.Oral retractor |
| d. ob. m. ...Demi-oblique-muscle | t.Testis |
| ed.Endostyle | v. d.Vas deferens |
| em.Embryo | xFirst atrial sphincter |
| ht.....Heart | I-VFirst to fifth body muscles |

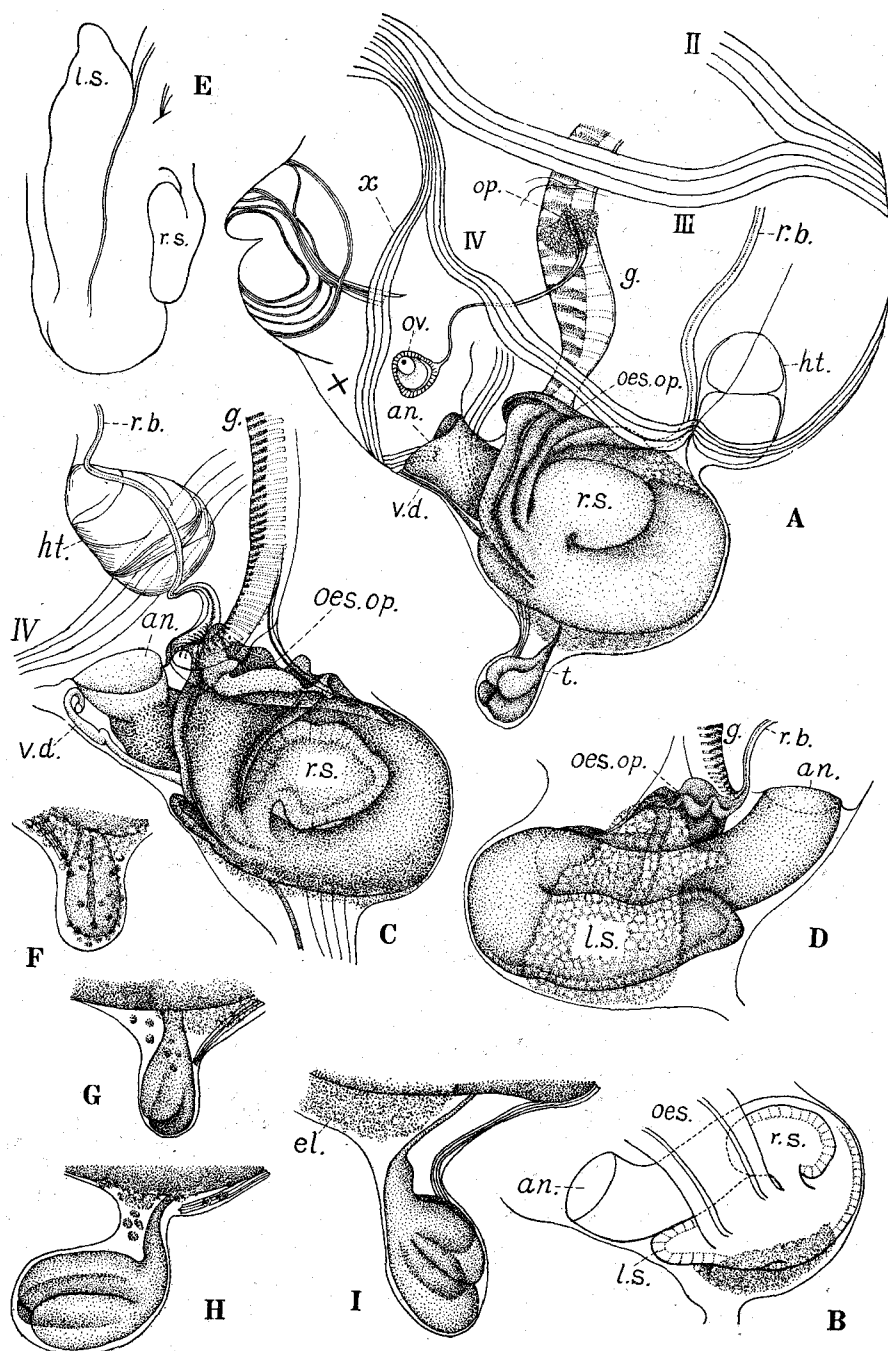
PLATE X

Brooksia rostrata (TRAUSTEDT), aggregated form.

- A...Posterior part of a dextral individual, right side, $\times 110$.
 B...Nucleus of the same individual located obliquely to show both right and left blind sacs, $\times 110$.
 C...Nucleus and adjacent region of a sinistral individual, left side, $\times 50$.
 D...Nucleus of the same individual, right side, $\times 50$.
 E...Nucleus of the same individual, from posterior side, $\times 50$.
 F...Testis with a single follicle, $\times 200$.
 G...Testis with two follicles, $\times 200$.
 H...Testis with three follicles, $\times 200$.
 I...Testis with four follicles, $\times 200$.
- | | |
|---------------------------------|-------------------------------------------|
| an.Anus | ov.Ovary |
| el.Eleoblast | r. b. ...Retropharyngeal band |
| g.Gill | r. s.....Right blind sac |
| ht.Heart | t.....Testis |
| l. s.....Left blind sac | v. d. ...Vas deferens |
| oes.....Oesophagus | x.....First atrial sphincter |
| oes. op. ...Oesophageal opening | II-IV ...Second to fourth body muscles |
| op.Opening of oviduct | \timesOriginal situation of ovary |



T. TOKIOKA: AGGREGATED FORM OF *BROOKSIA ROSTRATA*.



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